

Remarks

Claims 1-9, 12-33, 35-38, and new claim 42 remain.

Claims 1-5, 7, 9, 10, 12-14, 16, 18, 20, 22, 23, 25, 27-32, 34-37, 39 and 41 have rejected under 35 U.S.C. §102(e) as being anticipated by Li et al (US 6,704,175 B2).

Applicants acknowledge the Examiner's statement that claims 6 and 11 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Independent claim 1 has been amended to include the limitation of claim 11; thus claim 1 and its dependent claims 2-9 and 12 are allowable. New claim 42 is claim 1 amended to include the limitations of claim 6 and intervening claims 4 and 2, and is allowable.

The Examiner has correctly cited Li as arguably anticipating independent claims 13 and 28. These claims have now been amended to structurally distinguish Applicants' invention over Li. These differences are not merely structural. Li does not teach or suggest Applicants' invention.

Applicants' invention provides longitudinal biasing of the free layer by *direct orthogonal magnetic coupling* between the free layer and a biasing layer through *an electrically conducting spacer layer*. The magnetization direction of the free layer is caused to be *orthogonal* to the magnetization direction of the biasing layer by *direct orthogonal magnetic coupling induced by the electrically-conducting spacer layer*, rather than by magnetostatic coupling at the edges of the free and biasing layers (Specification; page 7, line 27 to page 8, line 4). The spacer layer thickness should be *below the critical thickness where it exhibits antiferromagnetic exchange-bias interaction with the adjacent ferromagnetic layers*. (Specification; page 10, lines 23-25). This feature of the spacer layer is now present in amended claims 13 and 28.

In contrast, Li teaches a spacer layer 70 (Fig. 2) that is clearly *antiferromagnetic for the purpose of providing an exchange-bias field* to ferromagnetic free layer 90 so that free layer 90 is *longitudinally biased* (Li; col. 5, lines 15-19). The materials for Li's spacer layer 70 are the well-known materials that are capable of exhibiting antiferromagnetic exchange-biasing (Li; col. 5, lines 23-27) and are the same materials suggested for the magnetically-coupling layer in Applicants' invention. However, in Applicants' invention these materials do *not* exhibit antiferromagnetic exchange biasing because they are below a

critical thickness. Applicants' invention also claims other materials, like Cr and Mn (claim 25), that do *not* exhibit antiferromagnetic exchange biasing *at any thickness*. Proof that Li requires the spacer layer 70 to exhibit antiferromagnetic exchange biasing is established by the embodiment of Fig. 4, wherein if the spacer layer 70 is too thin to be antiferromagnetic, then longitudinal biasing must be provided by separate biasing layers 171, 172 (Li; col. 5, lines 52-62).

The inapplicability of Li to Applicants' invention can be understood by an explanation as to why the AP-bias layer 5 (Li; Fig. 2) is essentially unrelated to spacer layer 70. While it may appear that AP-bias layer 5 and spacer layer 70 (Li; Fig. 2) are somehow a structure similar to the biasing layer 244 and spacer layer 242 of Applicants' invention (Fig. 2), in Li these two layers are independent and unrelated. As explained above, the Li spacer layer 70 is *antiferromagnetic* and provides *longitudinal biasing to the free layer 90 by exchange biasing*. The Li AP-bias layer 5, on the other hand, provides a *net magnetic field transverse* to this longitudinal direction *for the purpose of balancing the transverse field 110a from pinned layer 110* (Li; col. 5, lines 4-6). Without the counterbalancing effect of the net field from AP-bias layer 5, the field 110a of pinned layer 110 would magnetostatically couple with the field 90a of free layer 90, which would adversely affect the desired *longitudinal magnetization direction 90a*. The counterbalancing effect of this net transverse field can be increased by making spacer layer 70 thinner so that AP-bias layer 5 is physically closer to pinned layer 110 (Li; col. 5, lines 52-55).

In view of the amendments to independent claims 13 and 28, Applicants' spacer layer or magnetically-coupling layer has the property of "exhibiting no antiferromagnetic exchange-biasing effect", which is a feature *not shown* by Li. In fact Li shows the contrary, namely that the Li spacer layer does exhibit antiferromagnetic exchange biasing to the free layer. Thus Li is no longer an anticipating §102(e) reference.

In view of amendments to Applicants' claims and the above comments, Applicants believe that this application is now in condition for a Notice of Allowance. The Examiner is invited to call Applicants' attorney if a telephone conference is needed to address any remaining issues.

Respectfully submitted,

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